XVII. *On a Method of describing the relative Positions and Magnitudes of the Fixed Stars; together with some Astronomical Observations.* *By the Rev.* Francis Wollaston, *LL.B. F. R. S.*

Read February 5, 1784.

FROM some alterations which have of late years been discovered, in the relative positions and apparent magnitudes of a few of the stars we called fixed, it seems not unreasonable to conclude, that there may be many changes among others of them we little suspect. This thought has led me into a wish, that some method were adopted whereby to detect such motions. The first idea which occurred to me was, to make a proposal to astronomers in general; that each should undertake a *strict* examination of a certain district in the heavens; and, not only by a re-examination of the catalogues hitherto published, but by taking the right ascension and declination of every star in their several allotment, to frame an exact map of it, with a corresponding catalogue; and to communicate their observations to one common centre. This is what I could be glad to see begun. Every astronomer must wish it, and therefore every one should be ready to take his share in it. Such a plan, undertaken with spirit, and carried on gradually with care, would, by the joint labours and emulation of so many astronomers as are now in Europe, produce a celestial Atlas far beyond any thing that has ever yet appeared.

But this would be a work of time, and not within the compaſs of every one. What I mean now to propoſe is more immediate; and not out of the reach of any who amuſe themſelves with viewing the heavenly bodies.

Meridian altitudes and tranſits can be taken but once in 24 hours; and, though accurate, are therefore tedious. Neither can any re-examination of them be made, but with the ſame labour as at the firſt. Equatorial ſectors are in the hands of few; and require great ſkill. Some more general method ſeemed wanting; to diſcover variations, which, when detected or only ſurmiſed, ſhould be conſigned immediately to a more ſtrict inveſtigation.

Turning this in my thoughts, I conſidered, that the noting down at the time the exact appearance of what one ſees, would be far more ſimple, and ſhew any alterations in that appearance more readily, than any other method. A Drawing once made would remain, and could be conſulted at any future period; and if it were drawn at firſt with care, a tranſient review would diſcover to one, whether any ſenſible change had taken place ſince it was laſt examined. Catalogues, or verbal Deſcriptions of any kind, could not anſwer that end ſo well.

To do this with eaſe and expedition was then the requiſite: and a teleſcope with a large field, and ſome proper ſub-diviſions in it, to direct the eye and aſſiſt the judgement, ſeemed to bid moſt fair for ſucceſs.

The following is the method which, after various trials, I have adopted, and think I may now venture to recommend.

To a night-glaſs, but of DOLLOND's improved conſtruction, which magnifies about ſix times, and takes in a field of juſt about as many degrees of a great circle, I have added croſs wires, interſecting each other at an angle of 45°. More wires

may be croſſed in other directions; but I apprehend theſe will be found ſufficient. This teleſcope I mount on a polar axis. One coarſely made, and without any diviſions on its circle of declination, will anſwer this purpoſe, ſince there is no great occaſion for accuracy in that reſpect: but as the heavenly bodies are more readily followed by an equatorial motion of the teleſcope, ſo their relative poſitions are much more eaſily diſcerned when they are looked at conſtantly as in the ſame direction. An horizontal motion, except in the meridian, would be apt to miſlead the judgement. It is ſcarcely neceſſary to add, that the wires muſt ſtand ſo as for one to deſcribe a parallel of the equator nearly. Another will then be a horary circle; and the whole area will be divided into eight equal ſectors.

Thus prepared, the teleſcope is to be pointed to a known ſtar, which is to be brought into the centre or common interſection of all the wires. The relative poſitions of ſuch other ſtars as appear within the field, are to be judged-of by the eye: whether at $\frac{1}{2}$, or $\frac{1}{3}$, or $\frac{1}{4}$ from the centre towards the circumference, or *vice verſâ*; and ſo with regard to the neareſt wire reſpectively. Theſe, as one ſees them, are to be noted down with a black lead pencil upon a large meſſage card held in the hand, upon which a circle, ſimilarly divided, is ready drawn. (One of three inches diameter ſeems moſt convenient.) The motion of the heavenly bodies in ſuch a teleſcope is ſo ſlow, and the noting down of the ſtars ſo quickly done, that there is moſt commonly full time for it without moving the teleſcope. When that is wanted, the principal ſtar is eaſily brought back again into the centre of the field at pleaſure, and the work reſumed. After a little practice, it is aſtoniſhing how near one can come to the truth in this way: and, though neither the right aſcenſions nor the declinations are laid down

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by it, nor the diſtances between the ſtars meaſured; yet their *apparent* ſituations being preſerved in black and white, with the day and year, and hour if thought neceſſary, written underneath, each card becomes a regiſter of the then appearance of that ſmall portion of the heavens; which is eaſily re-examined at any time with little more than a tranſient view; and which yet will ſhew on the firſt glance, if there ſhould have happened in it any variation of conſequence. It is obvious, that very delicate obſervations are not to be made in this way.

In order to explain my meaning more fully, a card ſo marked ſhall accompany this paper (ſee tab. V. fig. 1.). What I firſt happened to pitch upon was the conſtellation of Corona Borealis, which then fronted one of my windows; and which I have ſince purſued throughout in this method; making the ſtars α, β, γ, δ, ε, ζ, ϑ, ι, $\varkappa$, π, ϱ, σ, and τ, ſucceſſively central; together with one or two belonging to Bootes, for the ſake of connecting the whole together. Theſe I have transferred ſince on a ſheet of paper, to try how well they would unite into one map; which they have done with very little alteration. A copy of that ſhall alſo be laid before this Society (fig. 2.).

My deſign was, after marking down all ſuch ſtars as are viſible with ſo ſmall a magnifier, to go over the whole again with another teleſcope of a higher power, divided in the ſame way; and after that, with a third and a fourth; ſo as to comprehend every ſtar I could diſcern. That would diſcover ſmaller changes: but it muſt be a work of time, if attempted at all. After ſuch a rough map of the conſtellation is made, the endeavouring to aſcertain the right aſcenſions and declinations of theſe, may perhaps be adviſeable in the next place, rather than ſearching for more.

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In obſerving in this way it is manifeſt, that the places of ſuch ſtars as happen to be under or very near any one of the wires, muſt be more to be depended upon, than of what are in the intermediate ſpaces, eſpecially if towards the edges of the field: ſo alſo what are neareſt to the centre, becauſe better defined, and more within the reach of one wire or another. For this reaſon, different ſtars in the ſame ſet muſt ſucceſſively be made central, or brought towards one of the wires, where any ſuſpicion ariſes of a miſtake, in order to approach nearer to a certainty: but if the ſtand of the teleſcope be tolerably well adjuſted and fixed in its place, that is ſoon done.

In ſuch a glaſs it is very ſeldom that light is wanting ſufficient to diſcern the wires. When an illuminator is required, I find, that for this purpoſe, where you wiſh to ſee every ſmall ſtar you can, a piece of card or white paſte-board, projecting on one ſide beyond the tube, and which may be brought forward occaſionally, is better than one of any other kind. By cutting acroſs a ſmall ſegment of the object-glaſs, it throws a ſufficient light down the tube, though a candle is at a great diſtance; and one may loſe ſight of that falſe glare when one pleaſes, by drawing back the head, and moving the eye a little ſide-ways, and then one ſees the ſmaller ſtars juſt as well as if no illuminator were there.

This then is the method I would recommend to the practical aſtronomer, for becoming acquainted with the appearance of the ſtars, and ſetting a watch over the heavenly motions. After a very few trials, every one would find this eaſy. And if each perſon of every rank among aſtronomers would take a conſtellation or two under his care, the numbers who could undertake it in this way would compenſate for the defects of a plan which cannot aſpire at great accuracy. The labour of

it, even at firſt, is but little. It has coſt me more time indeed than I ought commonly to allot to mere amuſement; becauſe I had my apparatus to contrive, and ſeveral different and fruitleſs ſchemes to try, before I could ſatisfy myſelf. But a quarter, or at the moſt half, an hour is generally ſufficient for the marking of one pretty full card in this way: and when once the cards are marked, and a general map of the conſtellation is formed, a little time given to it in a fine evening, to examine whether the ſtars on ſuch or ſuch a card remain in their former poſition, is little trouble indeed. Perſeverance is moſt likely to be wanting, and therefore muſt be determined upon; becauſe, after finding things time after time juſt as they were, one's hopes of diſcovering any thing new will ſlacken. But the different ſtate of the air, or of one's own eye, will frequently occaſion a freſh ſtar to become viſible, or a ſmall one which had been noted down to ſeem to have diſappeared; and ſuch a mere accident will ſerve to re-kindle the deſire of purſuing it. Beſides, if we obſerve no change after a tolerable interval of aſſiduous ſearch, we may at any time turn to another conſtellation: yet ought we never to abandon the former entirely, after having once publickly undertaken it, without giving notice of our ſo doing.

In the cards or maps, it may be obſerved, I have not marked the reſpective ſizes of the ſtars. Nor have I diſtinguiſhed them in any way, excepting a few of them with BAYER's Greek letters. It was becauſe I have not hitherto ſatisfied myſelf how to do it. Some method muſt be uſed by every one, to deſcribe to himſelf what he means; but, in laying any thing before the public, a deference ought to be paid to what has been done by others. The calling any ſtar by a new name would breed confuſion: and as I was deſirous this ſhould appear before this

Society

Society in its firſt rude form, that a judgement might be made from it how far ſuch a ſcheme would promiſe ſucceſs, I was unwilling to look into catalogues or capital maps for the numbers or names of the ſtars, leſt I ſhould be tempted to adapt the poſitions of what I had obſerved to what I there found ſet down by more able aſtronomers. Nothing, therefore, but a hemiſphere of SENEX has been conſulted, juſt for knowing how far the conſtellation is uſually reckoned to extend, and what are BAYER's references.

Should this plan meet with approbation, I ſhall be happy to have propoſed it; and will endeavour to forward it in any way that ſhall be judged proper: or ſhould any other be preferred, which is within the abilities and leiſure of one who is engaged in another profeſſion, I ſhall be as happy to lend what aſſiſtance I can to it. My aim is only, to render ſuch obſervations as I am capable of making, uſeful to ſcience.

Before I conclude on this head, give me leave to add a few hints. Whether this method be followed, or any other, if a *general plan* be ſet on foot, whoever undertakes a conſtellation, or diſtrict, ſhould determine to examine it with as great accuracy as he can; yet never be aſhamed to let others know of his miſtakes. The error of one proves a caution to another. Such a rough ſketch, once made, will be found of great uſe to moſt of us, in knowing which ſtar next to examine with greater care. He who can do no more than this, will do a uſeful work by going thus far: and his frequently ſweeping over his diſtrict in this way, may lead him to a diſcovery which might eſcape a more regular aſtronomer. But whoever can, ought to do more. By degrees the exact poſitions of every ſtar he has noted down may be aſcertained, by the method practiſed by Mr. DE LA CAILLE in his Southern Hemiſphere, or by any

other which ſhall be eſteemed more convenient. Every one, indeed, muſt uſe ſuch inſtruments as he can procure: but aſſiduity can do more with indifferent ones, than will ever be accompliſhed with the very beſt without it. Whatever references are made for one's own convenience, when a map and catalogue are given to the public ſtock, the old letters and numbers ſhould be retained as far as they go: though yet notice ſhould be taken, where the magnitudes of the ſtars at preſent do not appear to correſpond with the order in which they have been laid down.

To render this more complete, it were to be wiſhed, that each ſhould give in a copy of his original obſervations, with an account of the inſtruments he uſed; ſince they ought to be preſerved as data from whence his deductions were made, which may then be re-examined at any future time. Yet muſt it be deſired, that no one would truſt himſelf without carrying on his calculations as faſt as the obſervations are made: they will otherwiſe multiply upon his hands till the labour will diſhearten him from attempting it at all. A heap of crude, undigeſted obſervations would be an unwelcome preſent to the public.

Having thus ſtated this Propoſal, I ſhall leave it to be proceeded upon, or not, as ſhall be ſeen proper: And will now only ſubjoin a Liſt of ſuch occaſional obſervations as I have had opportunity of making, ſince the laſt which I communicated to this Society. I find, indeed, that it is much longer than I had apprehended: but as I perceive ſome aſtronomers abroad have referred to a few of thoſe which have been honoured with a place in our Tranſactions, it may be as well to follow it up. An obſervation retained among one's own private papers I hold to be of little uſe.

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One thing let me deſire Foreigners to remark: that the regiſters I gave of the going of my clock were meant only as the relations of a *mere fact*; that a clock, of ſuch a conſtruction, kept or altered its rate *ſo* or *ſo*. They ſeem to have underſtood it as an account of a capital clock, by valuing themſelves upon ſome of theirs going better. The time-keepers in moſt of our Obſervatories are far more accurate; but, excepting thoſe of the Royal Obſervatory at Greenwich, their accuracy is not made public.

Another remark it may alſo be proper to make; that, ſince my former papers, the longitude of this place has been aſcertained by comparative obſervations on the burſting of ſome rockets, let off on purpoſe; which, on a mean of ſeveral, turns out to be 19″,02 in time E. of Greenwich Obſervatory; that is, it may hereafter be conſidered as 19″, inſtead of 18″,6 as I had before calculated it trigonometrically from the bearings.

Obſervations made at Chiſlehurſt, *in* Kent, *longitude* 19″ *in time Eaſt of the Royal Obſervatory at* Greenwich, and *latitude* 51° 24′ 33″ *North.*

Eclipſe of the moon, ♂ July 30, 1776: obſerved with a 3½ feet achromatic teleſcope, and a power magnifying 29 times (that is, a ſingle eye-glaſs belonging to the day-tube) the aperture of the teleſcope being reduced to 1½ inches. The night very clear and ſtill.

Apparent time. h.	′	″	
			The beginning not properly obſerved.
10	11	31	Grimaldus touched by the ſhadow.
10	12	49	——— covered.
10	14	5	Galilæus covered.
10	19	36	Ariſtarchus covered.
10	26	0	The ſpot in Kepler biſected.
10	24	25	Schikardus (but ♀) touched.
10	25	52	- - - - - - biſected.
10	27	19	- - - - - - covered.
10	28	15	Copernicus touched.
10	29	49	- - covered.
10	31	22	Helicon (but ♀) covered.
10	37	9	Plato touched.
10	37	54+	- covered.
10	38	55	Tycho touched.
10	39	39	- - biſected.
10	40	25	- - covered.

Manilius

Apparent time.

h.	′	″	
10	43	16	Manilius covered.
10	46	51	Menelaus covered.
10	48	5	Dionyſius covered.
10	55	4	Cenſorinus covered.
10	58	57	A point (Promontorium acutum, I believe) touched.
11	0	21	A ſpot between M. Fœcunditatis and M. Nectaris touched.
11	0	23	M. Criſium touched.
11	3	55	- - - covered.
11	7	57	The eclipſe ſeemingly total.
11	11	11	The moon covers a ſmall ſtar near her ſouth limb. The ſtar hangs on the limb, before it diſappears.
11	28	17	She covers another ſtar a little ſouth of her centre. This vaniſhes inſtantaneouſly.

Theſe occultations were obſerved with another power of the ſame teleſcope; which is uſually reckoned 100, and which I have formerly ſo called; but which on an accurate examination really magnifies almoſt 75 times.

The emerſions of theſe ſtars were not obſerved.

12	43	0	I judge the beginning of the emerſion to be about this time; but cannot be certain.
12	48	1	Grimaldus quitted by the ſhadow.
12	58	25	Ariſtarchus quitted.
12	59	22	Kepler biſected.
13	0	15	Tycho begins to emerge.
13	1	9	- - biſected.
13	1	53	- - emerges. Till this time I had uſed the whole aperture (3,6) having forgotten to reduce it.

Apparent time.
h. ′ ″

it, till the moon's brightneſs reminded me. Same power as at firſt; that is, 29.

13 6 51 Copernicus begins to emerge.
13 7 20 - - - ſeemingly biſected.
13 8 19 - - - emerges.
13 10 27 Helicon emerges.
13 15 26 Plato begins to emerge.
13 16 31 - - emerges.
13 21 30 Manilius emerges.
13 23 54 Dionyſius emerges.
13 24 57 Menelaus emerges.
13 29 47 Cenſorinus emerges.
13 31 21 The ſpot by M. Fœcunditatis emerges.
13 35 31 The point of Prom. Acutum emerges.
13 37 21 + M. Criſium begins to emerge.
13 40 26 - - - quitted by the ſhadow.
13 42 0 The end of the eclipſe.

The air was very clear and ſtill the whole time: the ſhadow but ill defined. Indeed, it was little more than a penumbra; the principal ſpots remaining always viſible on the moon's duſky face.

Eclipſe of the ſun ☿ June 24, 1778: obſerved with a $3\frac{1}{2}$ feet achromatic teleſcope magnifying 75 times. The aperture reduced to two inches, to prevent breaking the ſmoked glaſſes.

3 41 33,5 Beginning. I ſuſpect the minute to be miſtaken, and that it ſhould be 3 h. 40′ 33″,5. The firſt impreſſion

Apparent time.
h. ′ ″

impreſſion could not be 2″, I believe not 1″, before I obſerved it.

5 25 24 End. An undulation on the ſun's limb; but the obſervation pretty good.

Eclipſe of the moon ♂ November 23, 1779: obſerved with the ſame teleſcope, magnifying 75 times. The aperture reduced to two inches. Night clear and froſty. No wind.

The beginning not aſcertained.

6 13 19 Grimaldus touched by the ſhadow.
6 13 28 - - - covered.
6 17 29 Ariſtarchus covered.
6 20 46 Kepler biſected.
6 23 40 M. Humorum touched.
6 27 47 Helicon covered.
6 28 40 Copernicus and Timocharis both biſected.
6 29 57 M. Humorum covered.
6 33 50 Plato touched.
6 34 27 - - covered.
6 41 52 Tycho touched.
6 43 8 - - covered.
6 47 11 Plinius (but ♀) covered.
6 59 1 M. Criſium touched.
7 3 16 - - - covered.
7 7 31 The eclipſe total.
8 46 23 Moon's edge begins to emerge.
8 51 14 Grimaldus begins.
8 52 1 - - - emerges.

A haze comes on.

Apparent time.
h. ′ ″

9 2 23 :: Kepler biſected. This not clearly ſeen.
9 11 41 Plato begins to emerge.
9 12 35 - - emerges.
9 13 46 Tycho emerged.
The haze comes on again too much for the obſervation to be purſued any farther.

Eclipſe of the ſun ♂ Oct. 16, 1781: obſerved with the ſame teleſcope and magnifying power.

The beginning not viſible; ſun too low.
20 22 13,5 The end. Good.

Eclipſe of the Moon ☿ Sept. 10, 1783: obſerved with the ſame teleſcope, *viz.* $3\frac{1}{2}$ feet achromatic, with the aperture reduced to two inches; but with a ſmall magnifying power of 36 times, which I had made by Mr. DOLLOND for theſe obſervations, and which I found very convenient. Night a little hazy, but pretty favourable.

9 33 0 A duſkineſs comes on the moon.
9 45 35 The beginning of the ſhadow, I believe.
9 47 20 A hazineſs obſcures the moon.
9 50 55 Ariſtarchus covered.
9 52 20 Kepler covered. So it is ſet down; but I do not recollect what I meant by this; whether it might not be only the ſpot in the centre, ſo that it might more properly be called biſected.

Gaſſendus

Apparent time.

h.	′	″	
9	57	57	Gaſſendus covered. I ſuſpect the minute here; and that it ſhould be 56′ 57″.
9	59	41	Heraclides covered.
10	1	42	Copernicus touched.
10	3	5	- - - covered.
10	3	26	Helicon covered.
10	4	12	Bulialdus covered.
10	8	0	A hazineſs again.
10	8	57	Plato covered.
10	15	30	Manilius covered.
10	15	54	Tycho touched.
10	17	5	:: - - covered. This doubtful.
10	19	10	Menelaus covered.
10	21	38	Dionyſius covered.
10	22	40	Plinius covered.
			A hazineſs again.
10	28	25	Cenſorinus covered.
10	34	34	M. Criſium touched.
10	39	45	- - - covered.
10	46	34	Total darkneſs, as I judged it.
			At 10 h. 41′ the moon had grown reddiſh, and the eclipſed part become more viſible than before. After ſome time, during the total darkneſs, the moon was barely to be ſeen. In general, about the centre, it was darker than towards the circumference, which was ill-defined. About
12	0	0	The eaſtern limb became more viſible, and better defined.

Apparent time.

h.	′	″	
12	14	0	The light ſpreads a great way over the moon from that ſide towards the centre, extending about two-thirds of her circumference (ſee fig. 3.)
12	23	0	The moon ſeems beginning to emerge.
12	25	0	Emerſion certainly has begun.
12	28	21	Grimaldus emerged.
12	31	40	Galileus emerged.
12	33	52	Ariſtarchus emerged.
12	37	26	Kepler (but ♀. this as before).
12	39	36	Heraclides emerged.
12	42	56	Helicon emerged.
12	45	52	Copernicus emerged entirely.
12	47	22	Plato begins to emerge.
12	47	58	- - emerges.
12	48	30	Tycho begins to emerge.
12	49	58	- - emerges.
12	58	8	Manilius emerges.
13	1	40	Menelaus emerges.
13	3	18	Dionyſius emerges.
13	5	40	Plinius emerges.
13	11	22	Cenſorinus (but ♀.) emerges.
13	16	35	M. Criſium begins to emerge.
13	20	53	- - - emerges.
13	25	38	The ſhadow quits the moon near Langrenus, between that and M. Criſium. The duſkineſs does not leave the moon till ſome time afterwards, but I did not wait to obſerve it.

The moon was darker during the eclipſe than uſual; but the air was not clear enough for any occultations of ſtars to be obſerved.

Tranſit

Tranſit of Mercury over the ſun's diſk ☿ Nov. 12, 1782: obſerved with the ſame teleſcope, and a power of 75 times. The aperture reduced to two inches.

Apparent time. h.	′	″	
2	51	49	Firſt impreſſion obſerved. It could not be 2″ ſooner.
2	54	57	Thread of light completed; but ſeen through clouds. The planet ſeemed to hang on the ſun's limb 30″ at leaſt.
4	6	0	Through a break in the clouds, of ſhort duration, ☿ ſeemed to have quitted the ſun; but indeed the clouds were very unfavourable the whole time.

Occultation of Saturn by the moon, ♄ February 18, 1775: obſerved with the ſame teleſcope; and, I believe, the ſame power, with the whole aperture of the object-glaſs 3,6 inches; but, I perceive, I have not ſet down theſe particulars.

9	5	39	Præc. anſa of the ring im,
9	6	9	Præc. limb of the planet im.
			Subſequent limb not ſet down.
9	6	48	Subſequent anſa im.
			The moon low at theſe immerſions, and much undulation. The emerſions loſt by looking at a wrong part of the moon's diſk, except
10	1	7	Subſequent anſa emerges.
			Night very clear; but the obſervation on the whole imperfect.

Occultations

Occultations of ſtars by the moon: obſerved with the ſame teleſcope, and a power of 75 times, with the whole aperture of the object-glaſs.

		Apparent time. h. ′ ″	
1775.			
♂ Aug. 1.	☽ γ Virginis	7 48 17	Both ſtars viſible when a cloud covered them.
		7 49 20	A ſhort break; only one ſtar viſible.
		7 52 15	Another break; but before this the ſecond ſtar was immerged.
		8 48 58,5	Firſt ✳ em. good.
		8 49 6,5	Second ✳ em. good.
	☽ a bright ✳ N of γ Virginis	8 54 13	Im. good.
			Em. not till the moon was too low.
♂ Dec. 12.	☽ Regulus	10 5 46	Em. very good, though the moon low.
1776.			
☉ June 30.	☉ I ad μ ♑	9 3 49	Im good; ſome flying clouds.
		10 6 38	Em.; perhaps ſooner.
1777.			
♄ Aug. 23.	☽ μ Ceti	10 41 17	Im.: the moon low; night clear and ſtill.
		11 32 10	Em.
♄ Nov. 15.	☽ I ad δ Tauri		Im. not ſeen; undulation too great.
		7 22 56	Em. pretty good.
☉ Nov. 16.	☽ ζ Tauri	11 17 1,5	Im. good.
		12 23 28	Em. good.

These were obſerved with a power of 67 times, and an oblique ſpeculum.

1783.			
♀ May 16.	☽ π Scorpii	11 21 49	Im.
		12 31 49,5	Em.

Night clear and ſtill; the obſervations good.

♃ Jul 10.	☽ π Scorpii		Im. not ſeen for clouds.
		8 43 56	Em.; it might be 1″ or 2″ ſooner; the moon's edge ill defined.
♂ Dec. 30.	☽ δ Piſcium	8 3 13	Im. dark limb, very good.
		9 8 30	Em. good. It could not be above 1″ ſooner, if that. Night very clear and ſtill; hard froſt; therm. 13°½.

Eclipſes of Jupiter's ſatellites: obſerved with the ſame teleſcope and power (that is, 75 times; called uſually 100) and whole aperture.

			Apparent time. h.	′	″	
1775.						
♀ Sept.	8.	1 Sat.	11	33	14	Im. flying clouds; obſervation doubtful.
☉ Oct.	1.	1 Sat.	11	51	1	Im. good; unleſs the minute be miſtaken.
♃ Nov.	2.	1 Sat.	8	28	2	Im. good.
♃	16.	2 Sat.	9	0	13	Im. pretty good; air clear, but a cold in my eyes rendered the obſervation not ſatisfactory.
☽ Dec.	18.	1 Sat.	10	45	48	Em. good.
		2 Sat.	11	2	0	Em. pretty good.
☿	27.	1 Sat.	7	3	48	Em. good.
1776.						
☉ Nov.	17.	3 Sat.	9	38	48,5	Im.; a ſcintillation for ſome ſeconds before it quite diſappeared.
1778.						
♃ May	21.	1 Sat.	9	9	38	Em. good.
		2 Sat.	10	10	±	Em. ſo near the firſt ſatellite; as ſcarcely to be diſtinguiſhable from it for ſome minutes.
♃ June	11.	4 Sat.	9	52	4	Im. good for the fourth ſatellite, yet viſible by fits for ſome ſeconds longer.
♄	13.	1 Sat.	9	19	6	Em. pretty good.
1779.						
♂ Mar.	9.	1 Sat.	6	59	19	Im.; that is, this was the laſt of my ſeeing it; but, though the night was clear, the ſatellite was too near Jupiter for the obſervation to be ſatisfactory.
♄ May	22.	2 Sat.	11	5	54	Em. good.
1781.						
♃ May	24.	1 Sat.	10	3	31	Em. very good.
♃	31.	1 Sat.	11	57	35	Em. pretty good.
♄ June	16.	1 Sat.	10	13	13	Em.; clouds, but pretty good.
1782.						
♄ July	20.	3 Sat.	9	6	42	Em. good.
		2 Sat.	11	30	30	Em. good.

Emerſion

			Apparent time. h. ′ ″	
☉ July	21.	1 Sat.	9 39 50	Emerſion; windy; but good.
♃ Aug.	29.	1 Sat.	8 20 15,5	Em.
☿	30.	4 Sat.	8 52 19	Em.; ſatellite ſeen then, but not diſtinct for ſome time.
1783.				
♂ July	8.	1 Sat.	12 14 13	Im. pretty good.
♄ Aug.	2.	1 Sat.	9 10 31,5	Em. good.
☽	25.	1 Sat.	9 28 54	Em.
☿ Sept.	26	1 Sat.	6 19 44	Em. pretty good, but twilight ſtrong.
♂	30.	3 Sat.	10 3 24	Im. It was viſible only by fits for the laſt 8″. Jupiter near a tree.
☿ Oct.	3.	1 Sat.	8 18 0	Em. pretty good; but the moon below Jupiter.
☉	26.	1 Sat.	8 39 17	Em. Jupiter low and near a tree; great undulation.

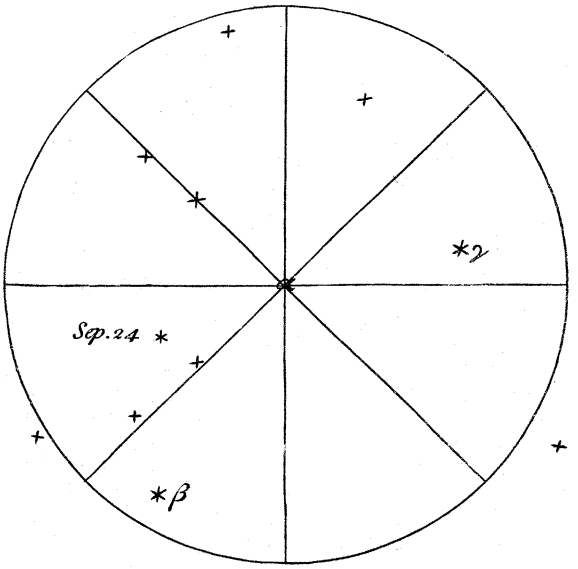
EXPLANATION OF THE FIGURES IN TAB. V.

Fig. 1. α Cor. Bor. ☿ Aug. 6, 1783, per night-glaſs. The * marked Sept. 24. was not obſerved till that night, but has continued ſince, and was only overlooked at firſt.

Fig. 2. A map of 107 ſtars, beſides thoſe marked by BAYER, in the conſtellation of Corona Borealis, or the Northern Crown; together with a part of Bootes: laid down from obſervations made 1783 with a night-glaſs furniſhed with croſs-wires; as their relative poſitions were eſtimated by the eye.

Fig. 3. The moon as ſhe appeared (inverted) ☿ Sept. 10, 1783, about a quarter of an hour before ſhe began to emerge from total darkneſs.

Fig. 1.



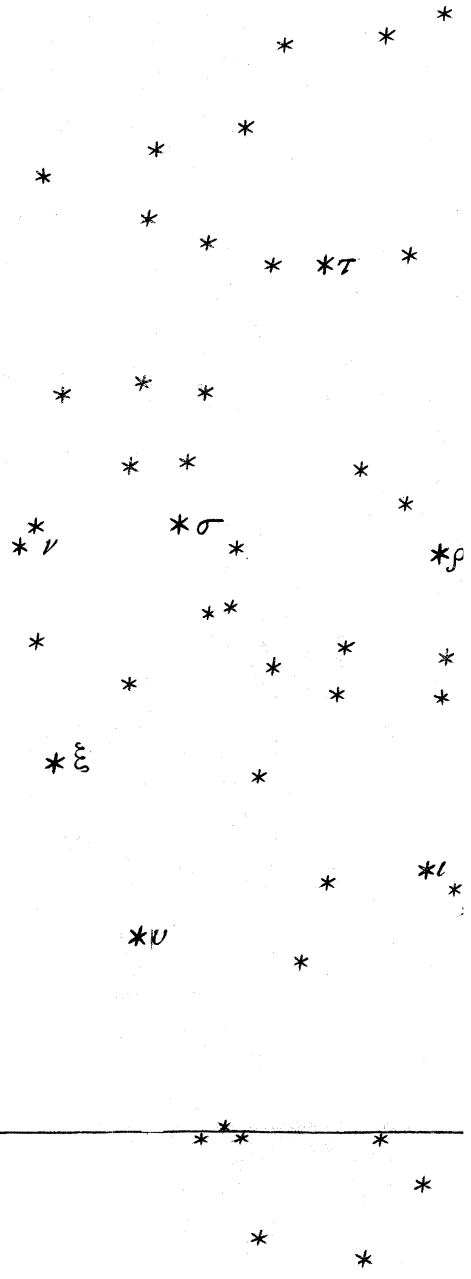


Fig. 3.

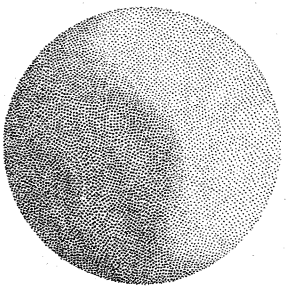


Fig. 2.

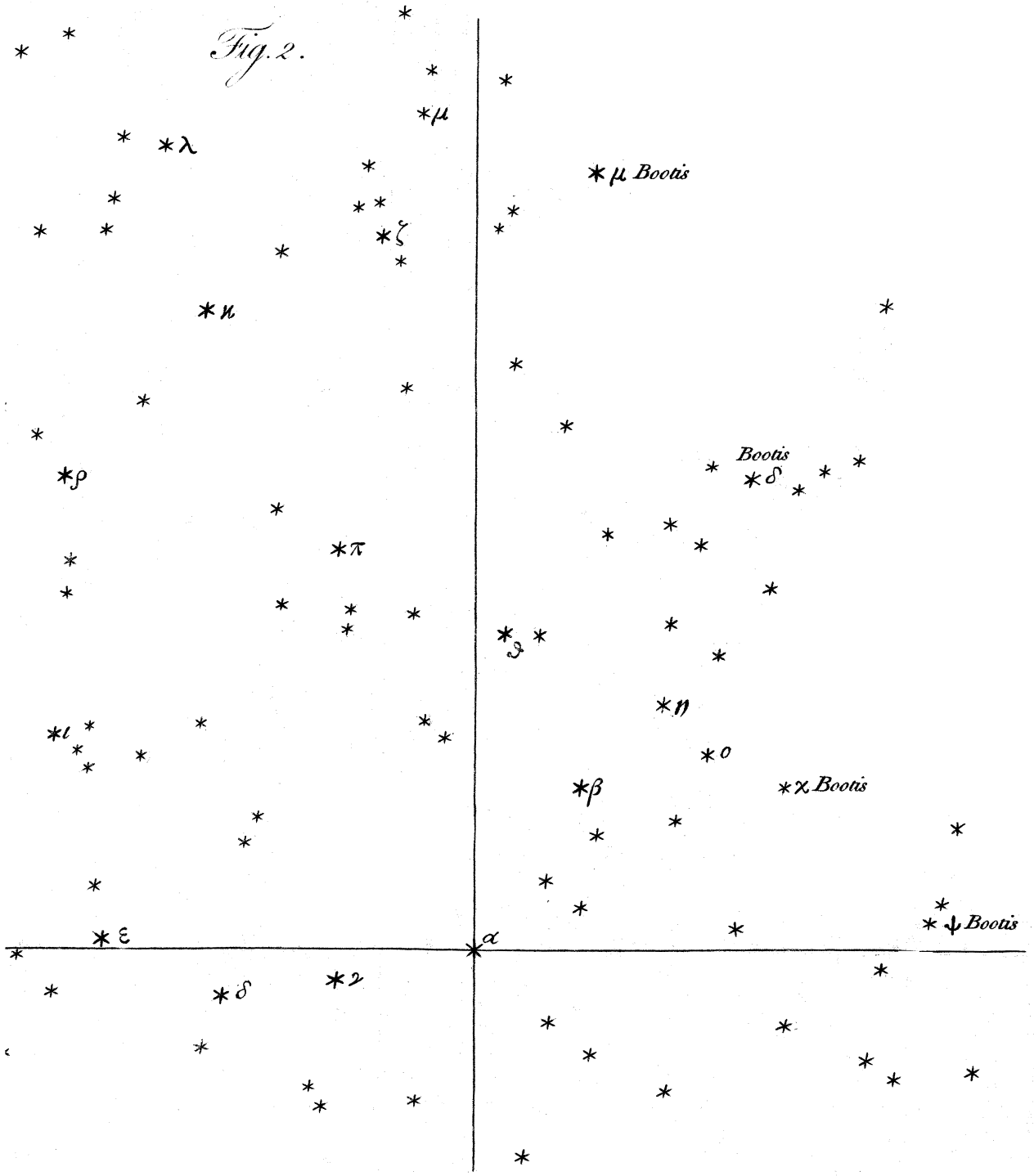


Fig. 1.

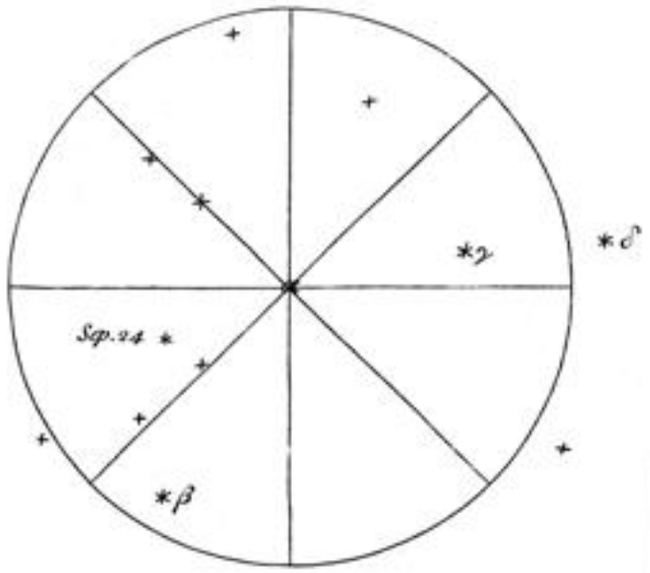


Fig. 3.

Fig. 2.